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AN 10-10CB-25

HANDBOOK
OPERATION AND SERVICE INSTRUCTIONS

GUN CAMERA

TYPE N-9
(BELL & HOWELL)

**PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE
AND THE CHIEF OF THE BUREAU OF AERONAUTICS**

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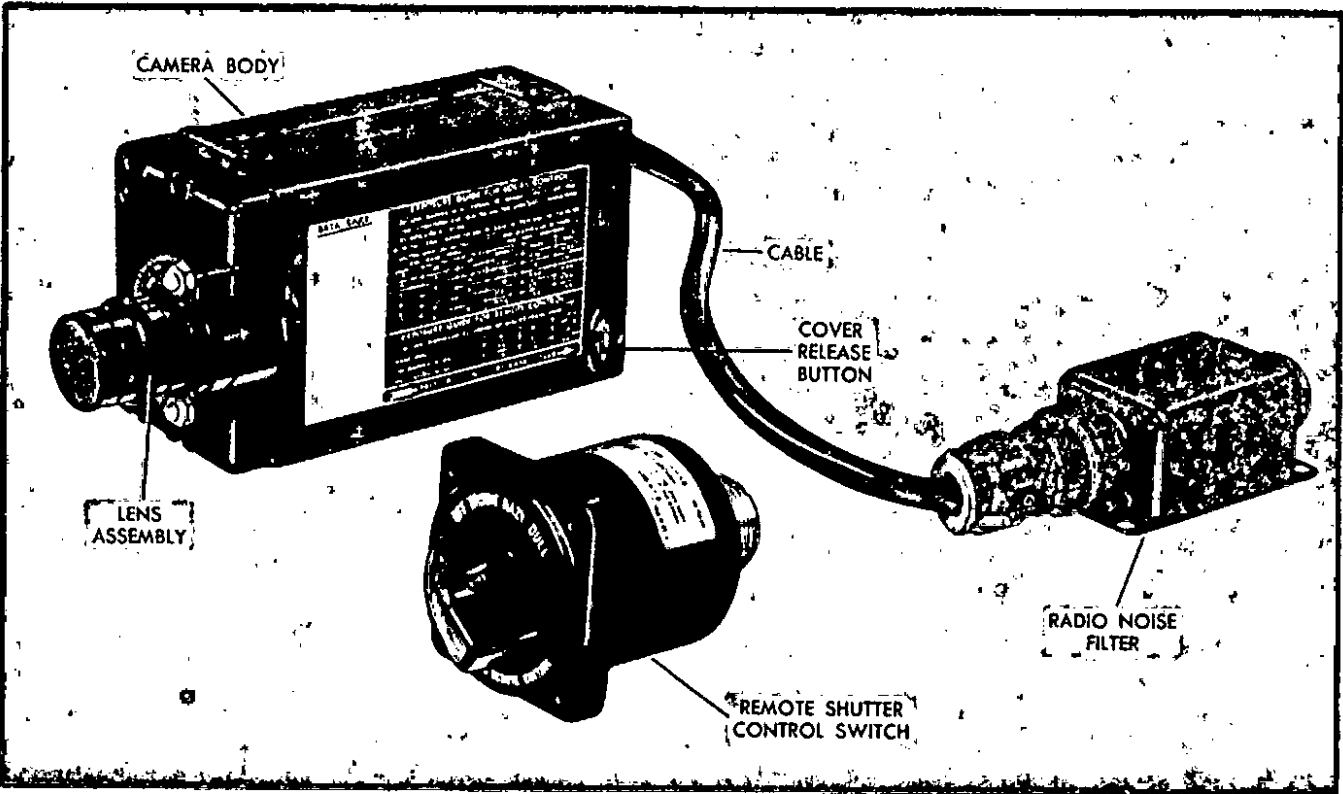


Figure 1-1. Components of Type N-9 Gun Camera

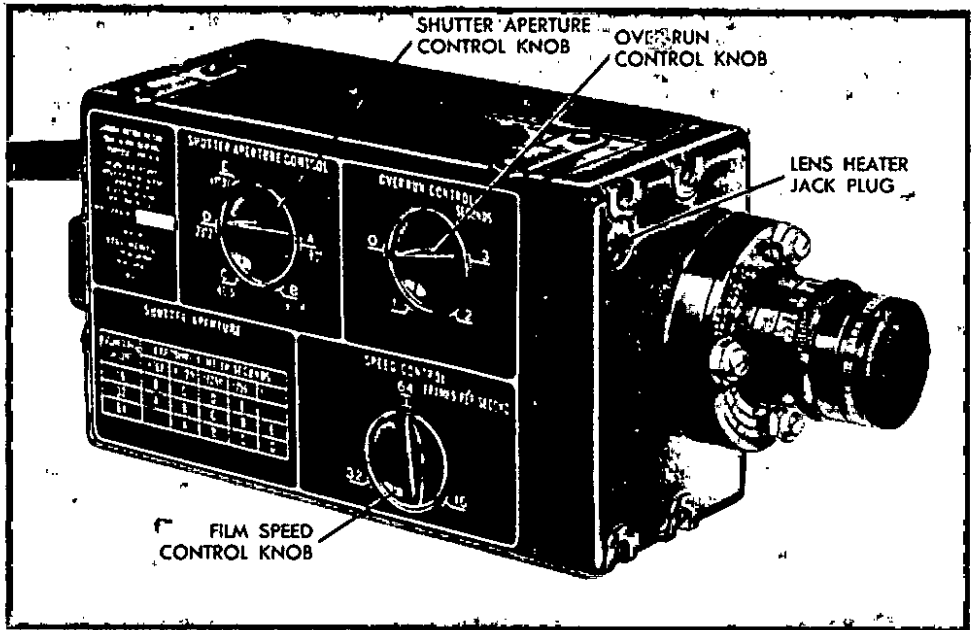


Figure 1-2. Type N-9 16-mm Motion-Picture Camera

INTRODUCTION

This handbook provides operating and service instructions for the Type N-9 16-mm Gun Day Camera. The instructions cover operation, inspection, lubrication and maintenance which can be performed by personnel of operating units.

The Type N-9 16-mm motion-picture camera (figures 1-1 and 1-2) operates on 24 to 29 volts dc and is designed for producing visible records of aerial combat or for recording results obtained in aerial gunnery training.

SECTION I

OPERATION

1-1. DESCRIPTION.

1-2. The Type N-9 motion picture camera is designed for use with standard 16-mm black and white or color film. The magazine will accommodate a film cartridge of 50-foot capacity. The magazine can be quickly removed from the camera for ease in loading.

1-3. The camera is calibrated to operate at speeds of 16, 32 and 64 frames (or pictures) per second. The selection of proper camera speed is made manually before take-off by means of a speed control knob (figure 1-2). This knob controls the gear train which, through a coupling with the magazine assembly, drives the film through the camera at the selected speed. Milled flats on the speed changer index shaft positively locate the knob at each speed setting, and prevent the speed from changing accidentally during operation of the camera.

CAUTION

The speed setting must not be changed while the camera is in operation.

1-4. The camera is equipped with an over-run control, the primary purpose of which is to continue the operation of the camera for a period of up to three seconds after the gun has ceased to fire. To make the over-run adjustment, the over-run control knob (figure 1-2) must be depressed and rotated to the desired setting of 0, 1, 2 or 3 seconds of over-run time. The knob must be properly seated after the adjustment is made.

1-5. The shutter aperture control knob (figure 1-2) permits manual adjustment of the shutter aperture, or opening, by rotation of a movable shutter blade. The primary advantage of this adjustment is that it eliminates the blur or "smear" which might otherwise result from high-speed photography, while retaining an effective wide opening for normal photography and poor light conditions. The control knob must be pressed in to disengage the control

knob gear from the remote control pinion; then rotated to the desired setting and released. A shutter aperture nameplate on the side of the camera body indicates the proper shutter aperture settings for various combinations of camera speed and exposure time per second. The following exposure guide chart indicates the proper lens diaphragm settings for various light conditions and speed and aperture opening combinations. The settings are based on the use of Class A film and yellow filter, and the shutter openings are indicated by letters corresponding to those around the control knob.

EXPOSURE GUIDE CHART (MANUAL)

Shutter Aperture Settings and Frame Speeds			Lens Diaphragm Settings for Light Conditions		
16	32	64	Bright	Hazy	Dull
B	A		f/22	f/11	f/5.6
C	B	A	f/16	f/8	f/4
D	C	B	f/11	f/5.6	f/2.8
E	D	C	f/8	f/4	f/2.8
	E	D	f/5.6	f/2.8	f/2.8

NOTE

The yellow filter should be used in extreme brightness conditions -- over water, snow, desert sand, and so forth. The clear filter serves to protect the camera lens from damage when the yellow filter is not being used.

1-6. When remote shutter control operation of the camera is desired, the lens diaphragm must be pre-set as indicated in the following chart. Selection of the shutter opening then can be accomplished electrically by the pilot during flight by rotating the knob of the remote shutter control switch (figure 1-3) to one of three positions --- DULL, HAZY or BRIGHT. The proper lens diaphragm opening is obtained by rotating the lens diaphragm control ring (figure 1-2), to the desired f-stop marking on the lens barrel.

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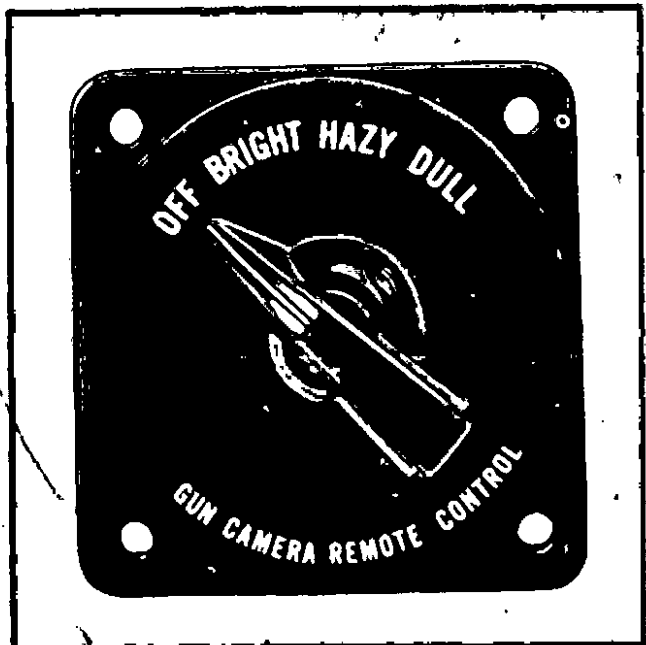


Figure 1-3. Remote Shutter Control Switch Box

EXPOSURE GUIDE CHART (REMOTE)

Frame Speed	16	32	64
Lens Diaphragm Setting (Day)	f/5.6	f/4	f/2.8
Lens Diaphragm Setting (Night)	f/2.8	f/2.8	f/2.8

1-7. The camera is equipped with a jack plug connector (figure 1-2) for the connection of an external lens heating unit to prevent frosting of the glass surfaces of the lens in extreme cold temperatures. The camera body also is equipped with heating elements. For extreme low temperature operation, these elements must be "on" for a minimum warm-up period of one-half hour. The camera heaters are operated by turning the remote shutter control switch to any one of its three light setting positions.

1-8. TECHNICAL DATA

Manufacturer Bell & Howell Co.
Manufacturer's design number Des. 917-A
Government model number Type N-9
Film size 16-mm
Film capacity 50 ft
Camera speeds 16, 32 and 64 fps
Standard lens 35-mm, f/2.8
Shutter opening variable
Voltage requirements 24 to 29 vdc
Approximate weight (camera and magazine) 3.75 lbs
Overall dimensions (camera and magazine):
Height 3-13/32 in.
Width 2.883 in.
Length (with lens and filter) 8 in.
Approximate current drain (at 28 vdc):
Camera motor 1-1/2 amp
Camera heater 1 amp
Magazine heater 1 amp
Over-run solenoid 1/4 amp
Remote control switch 1/4 amp

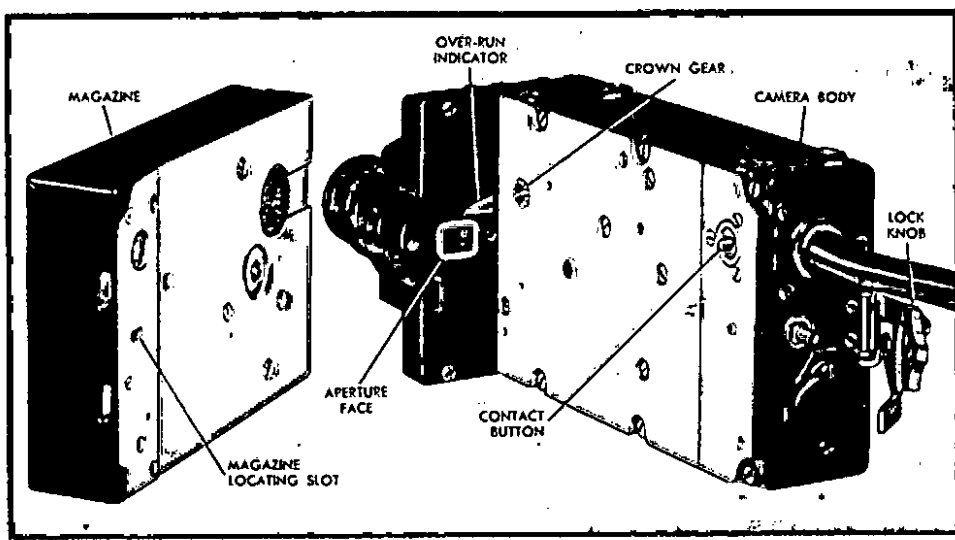
1-9. PRINCIPLES OF OPERATION.

1-10. GENERAL.

1-11. The Type N-9 camera consists basically of a camera body and a film magazine (figure 1-4). The camera body mechanism provides the driving power for the film magazine. The process of feeding the film past the magazine and camera exposure apertures is accomplished by the magazine mechanism and the film shuttle, or claw.

1-12. Both the camera body and film magazine are equipped with heater wires sealed against the inner face of each casting. The current required (24 to 29 vdc) to drive the camera mechanism and energize the heater wires is brought directly into the camera body through a short power cable. Mating contacts in the camera body and magazine provide the connection which supplies the current to the magazine heating wire. The contacts are so designed that the magazine can be installed or removed when electrical power is on without short-circuiting the

Figure 1-4. Film Magazine Separated from Camera Body



contacts through the magazine or camera body.

1-13. The film magazine (figure 1-5) contains the pressure plate, film guide arms and sprockets required for feeding the film past the aperture opening and for maintaining proper film alignment during operation. An automatic recycling counter also is provided to indicate the length of unexposed film in the magazine. The counter will recycle back to "50" when the magazine cover release button is depressed. The film sprockets are driven by a crown gear (figure 1-4) in the camera body.

1-14. SHUTTER OPERATION.

1-15. The camera shutter consists of two shutter blades, one of which can be rotated independently of the other to increase or decrease the size of the shutter opening. The shutter aperture adjustment can be made manually by means of the shutter aperture control knob, or electrically by means of the remote shutter control switch. In either case, the rotation of the rear shutter is accomplished by the same mechanical means.

1-16. In manual operation, the shutter control knob (figure 1-5) is pressed in until its large gear disengages from the remote control pinion of the shutter control assembly, thus by-passing the control motor and its gear train. The end of the control knob shaft is slotted to receive the flattened end of the shutter control camshaft. Therefore, rotation of the knob also will serve to rotate the control cam, the outer contour of which bears against a pivoting shutter control lever.

1-17. A hex head adjusting screw at the lower end of the control lever bears against the end of the shutter displacement shaft. As this shaft is forced toward the front of the camera (by the control lever) or toward the rear of the camera (by the return spring), the displacement gear causes the shutter shaft worm gear to turn, thereby rotating the rear shutter blade.

1-18. In electrical operation, movement of the remote shutter control switch to one of its three positions (BRIGHT, HAZY, or DULL) energizes the shutter control motor through the closed switch contacts for that particular position. Because the control knob gear (in its released position) is engaged by the remote control pinion, the knob and cam will be rotated by the motor through the gear train.

1-19. A locating pin in the shutter control cam engages a hole in the underside of the cylindrical cam switch. Thus, the cam switch actually is rotated by the cam. Three setscrews protrude from the periphery of the cam switch and are located to correspond with the contour variations of the cam. Each of these setscrews lies in the path of one set of switch contacts. As the cam switch rotates, the setscrews (one at a time) will separate the switch contacts. When the energized contacts are separated, the control motor will stop, halting the rotation of the rear shutter blade at that point.

1-20. SPEED CONTROL OPERATION.

1-21. Camera speed is controlled by a speed changer

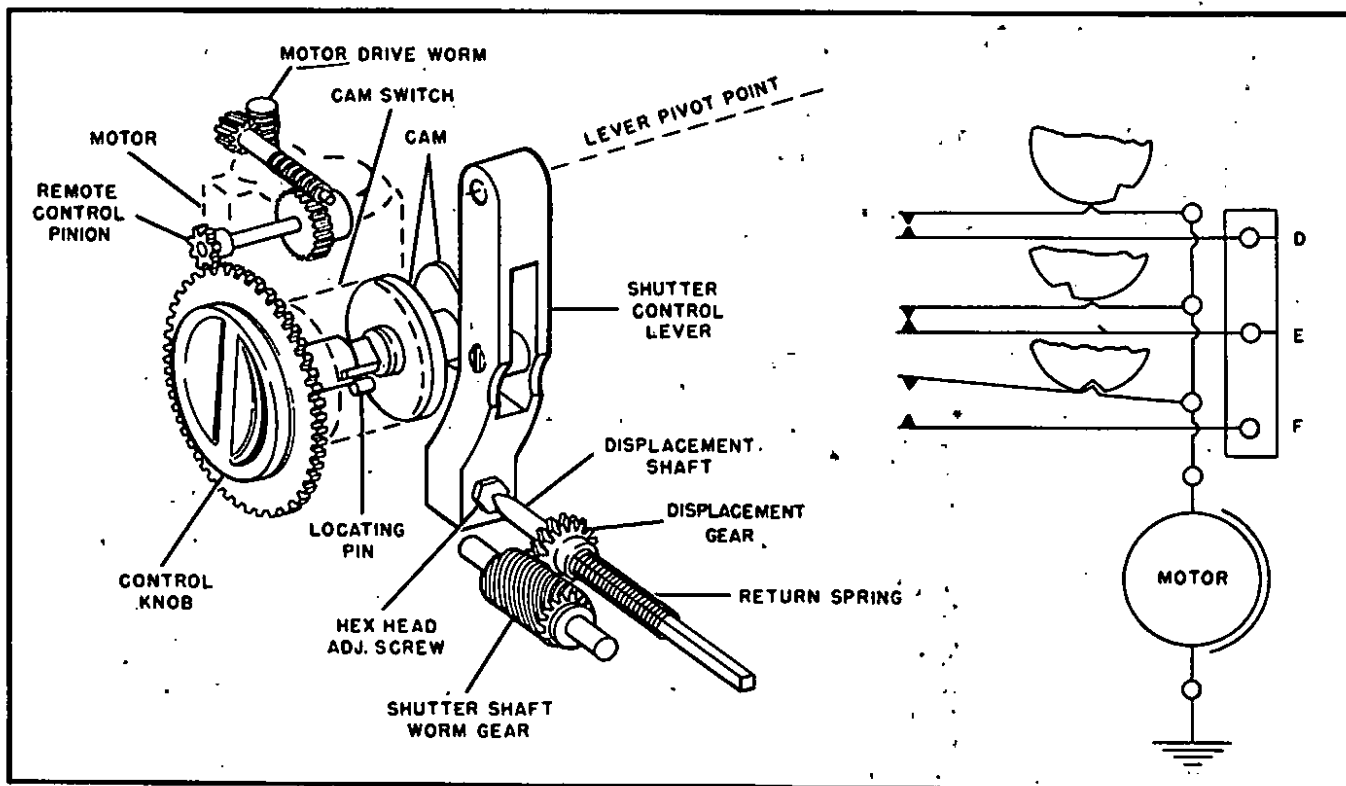


Figure 1-5. Diagrammatic View of Shutter Control Operation

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mechanism within the camera. Rotation of the speed control knob manipulates shifting levers which, by means of changing gear ratios, determine the speed at which the camera will operate.

1-22. OVER-RUN CONTROL OPERATION.

1-23. The electrical wiring arrangement for the camera is such that pressure on the gun trigger button completes the electrical circuit to the camera, which then begins to take pictures. Under ordinary circumstances, the removal of pressure from the trigger button would break the electrical circuit to the camera and halt the picture-taking process. However, the N-9 camera is equipped with an over-run control which permits camera operation to continue for a period of one, two, or three seconds after the trigger button has been released.

1-24. The desired amount of over-run time is set by means of the over-run control knob, figure 1-6. The outer rim of the control knob has been notched to match the "0", "1", "2" and "3" second over-run settings. The knob must be pressed in against the spring washer before it can be rotated. When the knob is released at the desired setting, one of the notches will engage a pin in the camera body to lock the knob at that position.

1-25. In actuality, the over-run cycle is controlled by the cam disc of the over-run plunger. The slotted plunger shaft protrudes down through the solenoid and engages the inner end of a clock spring. The tip of the shaft rests on the end of the over-run lever which, being under tension of a torsion spring, tends to force the plunger outward toward the control knob. While the plunger is in this raised position, note that the notched end of the over-run indicator is forced downward by the lever pin, thereby projecting the tip of the indicator into the corner of the aperture opening. Thus, all pictures taken after the guns have ceased firing will be identified by the appearance of the indicator tip in the upper right-hand corner of each frame.

1-26. Because the plunger clock spring has been assembled so as to unwind in a counterclockwise direction, the cam dog tends to bear against the control knob stop pin. When the gun trigger button is pressed, the electrical circuit is completed to the over-run solenoid and micro switch. The energized solenoid immediately pulls the plunger inward, disengaging the ratchet engaging ear from the ratchet teeth on the underside of the helical gear. While in this energized position, it will be noted that the end of the plunger shaft has pivoted the over-run lever in the opposite direction, thus

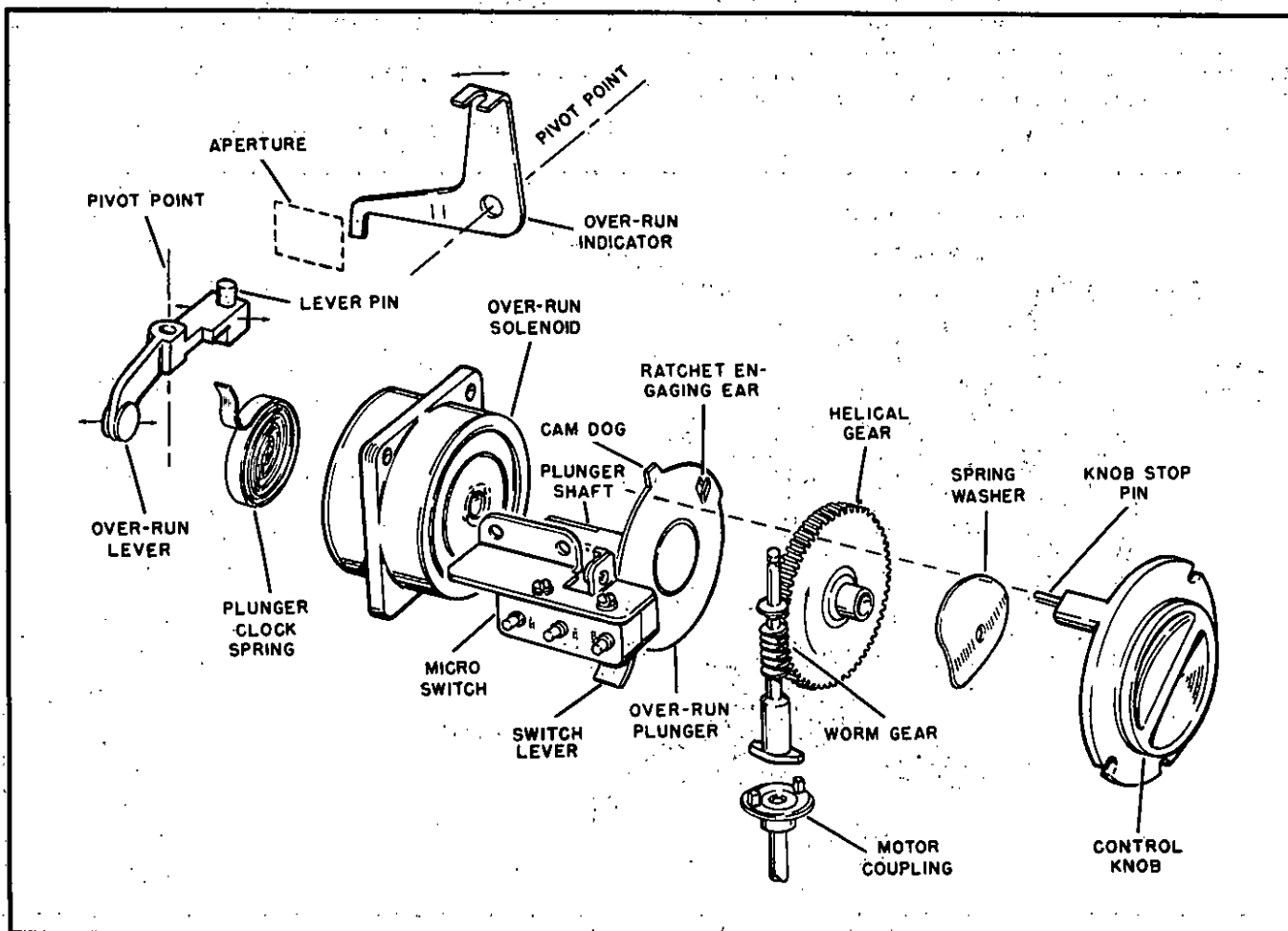


Figure 1-6. Diagrammatic View of Over-run Control Operation



Figure 1-7. Type A-2 Gun Camera Boresight Kit

withdrawing the tip of the indicator from the aperture opening.

1-27. The electrical hook-up of the micro switch is such that the switch button, when released, completes the circuit to the camera motor and the camera begins to operate. The motor coupling drives the worm gear which, in turn, drives the helical gear. When the trigger button is released, the solenoid is de-energized and the over-run lever forces the plunger outward until the ratchet engaging ear meshes with the ratchet teeth on the underside of the helical gear. When the control knob is set at "0" seconds, the cam lobe will immediately depress the micro switch button by means of a pivoting switch lever, thereby opening the circuit to the camera motor and stopping the camera. When the control knob is set for "1", "2" or "3" seconds over-run, the helical gear will drive the plunger cam clockwise until the cam lobe depresses the switch lever.

1-28. Clockwise rotation of the solenoid plunger winds the clock spring. Each time the trigger button is pressed, the energized solenoid will pull the plunger inward, disengaging the ratchet engaging ear from the helical gear. The unwinding clock spring causes the cam to spin around in a counter-clockwise direction until the cam dog strikes the control knob stop pin, thus preparing the mechanism for a repetition of the over-run cycle.

1-29. BORESIGHTING THE CAMERA.

1-30. At the initial installation of the camera and immediately after boresighting the guns, the optical axis of the camera must be aligned with the gun or gunsight. Boresighting is accomplished with the

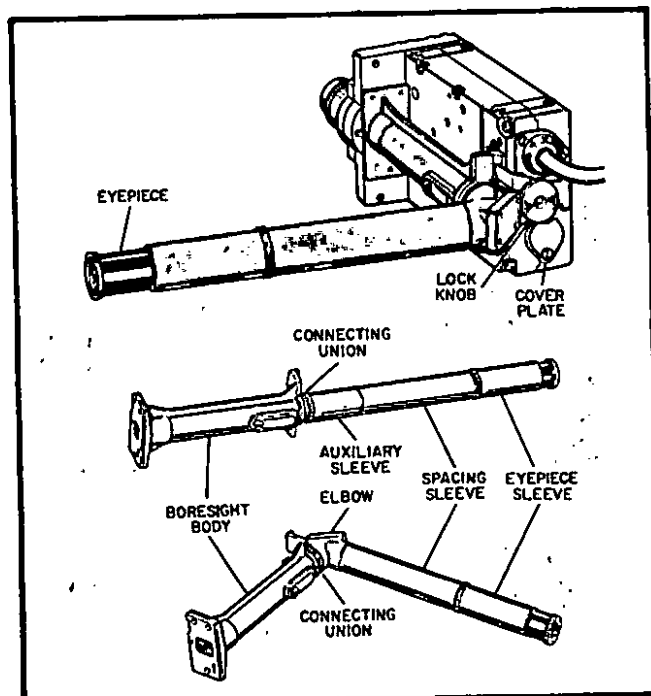


Figure 1-8. Assembling and Mounting the Boresight

use of the Type A-2 Gun Camera Boresight kit (figure 1-7).

1-31. The boresighting components can be assembled either for angular viewing or straight-line viewing as shown in figure 1-8. The procedure for boresighting is as follows:

- a. Clamp boresight to camera body with lock knob (figure 1-8) and open lens diaphragm to f/2.8.
- b. Swing cover plate away from opening and, while viewing through boresight eyepiece, rotate manual drive coupling with a screw driver until shutter blades no longer cover aperture opening.

CAUTION

Excessive use of manual drive coupling may damage over-run unit. Use sparingly.

c. Bring the crossed reticle lines of the boresight into sharp focus by sliding the boresight eyepiece slowly in or out of the eyepiece sleeve. The crossed reticle lines indicate the exact optical center (aiming point) of the camera.

d. If necessary, the camera mount now must be adjusted until the crossed reticle lines of the camera boresight are aligned with the same target used for boresighting the guns.

e. After boresighting is accomplished, tighten the camera mount attaching bolts securely to prevent the adjustment from shifting and remove the boresighting equipment from the camera.

1-32. LOADING AND INSTALLING THE MAGAZINE.

- a. Remove the magazine cover by depressing the cover release button (figure 1-9) and sliding the cover from the magazine body.

Paragraph 1-32

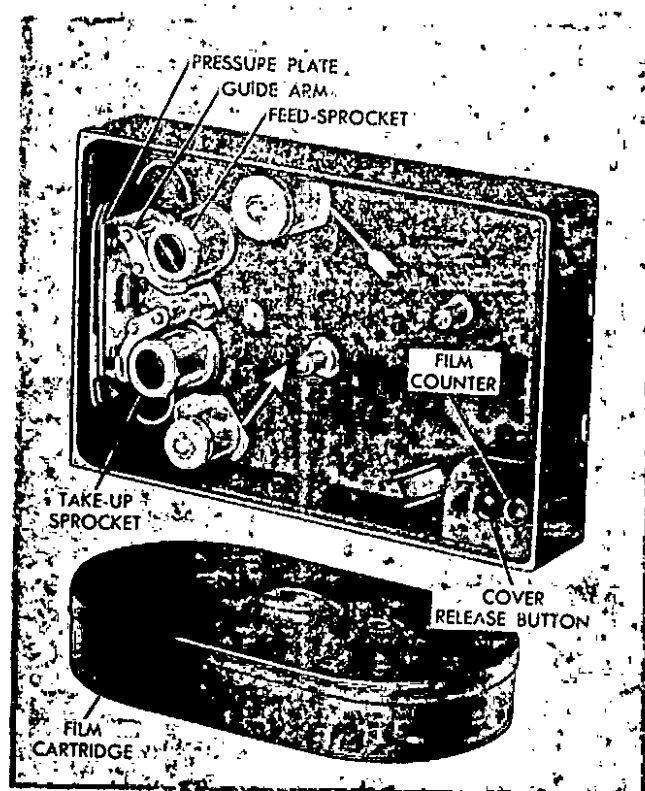


Figure 1-9. Film Magazine with Cover Removed

b. Open the film guide arms by swinging them away from their respective sprockets.

c. Pull approximately one foot of film from the feed spool of the cartridge. Place the cartridge diagonally across the magazine as shown in figure 1-10, and insert the film between the pressure plate and magazine aperture. Film must be aligned in milled slot of magazine and pressure plate must be down below guide rail at front of magazine.

d. Adjust film loops to sizes indicated by film path diagram in magazine. Note that lower loop is the larger of the two and, preferably, should

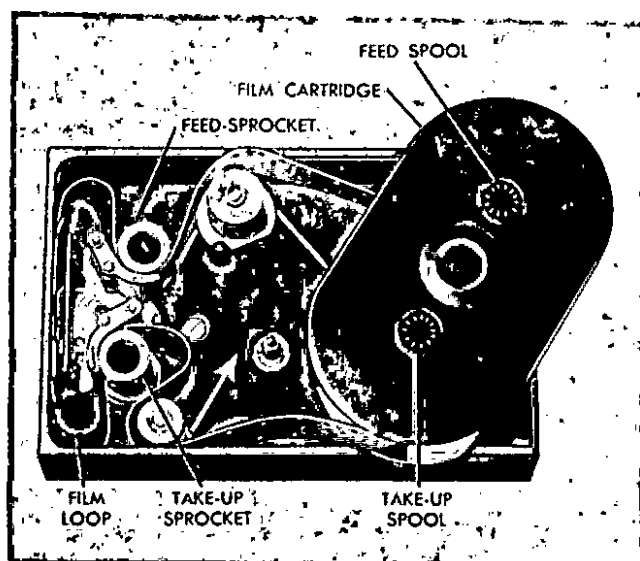


Figure 1-10. Threading Film through Magazine

exceed slightly the indicated pattern. Then thread film over sprockets, making certain that perforations are properly seated over sprocket teeth. Insert film cartridge into magazine (figure 1-11).

e. Close film guide arms securely and check alignment of film by rocking the film gently back and forth on sprocket teeth.

f. Draw excess film back into film cartridge by rotating cartridge feed spool counterclockwise and take-up spool clockwise. Make certain that there is no excess slack on the take-up spindle.

g. Make a final check of the film threading; especially the formation of the film loops (step d). Make certain that film is seating properly in film channel at front of magazine, and install cover.

NOTE

Failure of the cover to close properly indicates that the sprockets have not been completely seated or that the pressure plate has been installed upside down.

h. Before installing the magazine to the camera body carefully remove all dust and film emulsion deposits from the chromium-plated aperture face (figure 1-4). Insert the magazine so that its locating pin enters the mating hole to the right of the camera aperture and the camera locating pin enters the slot near the back end of the magazine. Press the rear end of the magazine firmly against the camera body, swing the magazine lock (figure 1-4) into place, and tighten the knurled lock knob securely.

NOTE

Two shallow indentions have been drilled into the under surface of the knurled lock knob. These indentions match two button-like extrusions on the upper surface of the magazine lock. When the knob has been turned down tight, make certain that the lock knob indentions drop down over the lock buttons. This will prevent accidental loosening of the magazine due to vibration.

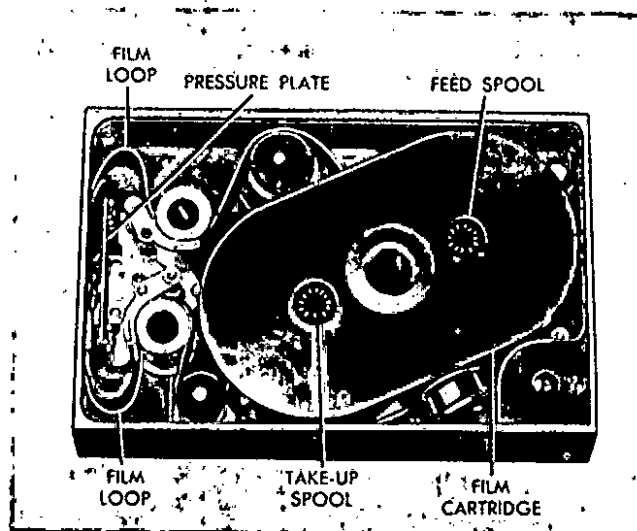


Figure 1-11. Inserting Cartridge into Magazine

1-33. SIMPLIFIED OPERATING PROCEDURE.

- a. Check installation of camera equipment in aircraft to make certain that all attaching parts and connections are secure.
- b. Load and install the magazine (paragraph 1-32).
- c. If local control of the camera is desired, set the shutter aperture, camera speed and lens diaphragm as instructed in paragraph 1-5.
- d. If the camera is to be operated remotely by the pilot during flight, set the camera speed and lens diaphragm as instructed in paragraph 1-6.

The pilot then must determine the light conditions (BRIGHT, HAZY or DULL) during flight, and set the remote shutter control switch accordingly.

e. For extreme cold temperatures, plug the external lens heating unit into the jack plug at the front of the camera and turn the remote shutter control switch to any one of its three light-setting positions at least one-half hour before the camera is to be operated.

f. When photography has been completed, snap the remote shutter control switch back into the off position.

SECTION II

SPECIAL SERVICE TOOLS

NOTE

Except for the Type A-2 Gun Camera Bore-sight, no special service tools are required for the proper inspection or maintenance of the Type N-9 camera.

SECTION III

PERIODIC INSPECTION AND LUBRICATION

3-1. PERIODIC INSPECTION.

Component	Nature of Inspection	Inspection Time
Camera	Mounting parts and electrical connections secure.	Daily
Shuttle tooth	Undistorted and free of film emulsion.	Daily
Aperture opening	Free of dirt and film emulsion.	Daily
Lens and filters	Clean and unscratched.	Daily

Component	Nature of Inspection	Inspection Time
Magazine sprockets	Teeth unbroken and free of film emulsion.	Daily
Film path	Free of dirt and dust.	Daily
Remote exposure control switch	Mounting parts and electrical connections secure.	Daily

3-2. LUBRICATION.

3-3. Lubrication of camera parts is required only at regular overhaul periods, which should not exceed ten hours of actual camera running time.

Paragraph 4-1

SECTION IV

MAINTENANCE

4-1. TROUBLE SHOOTING

Trouble	Probable Cause	Remedy
Magazine film guide arm has no tension	Film guide plunger spring broken	Return magazine to overhaul depot for repair.
Magazine cover will not close	Sprockets not seated or pressure plate inverted	Seat sprockets and/or install pressure plate properly.
Camera does not run	Power cable loose	Check cable connections.
	Film incorrectly threaded	Rethread film (para. 1-32).
	Accumulation of dirt and emulsion on pressure plate	Clean pressure plate.
	Defective over-run micro switch or wiring	Return camera to overhaul depot for repair.
Scratches on film	Micro switch too far away from over-run cam	Adjust switch (para. 4-12c).
	Pressure plate or magazine aperture dirty	Clean pressure plate and aperture.
Pictures consistently too dark or too light	Pressure plate nicked or otherwise damaged	Replace pressure plate.
	Shutter control lever out of adjustment	Adjust lever (para. 4-14).
Pictures unsteady	Faulty remote exposure control switch	Replace switch.
	Camera insecurely mounted	Tighten mounting parts.
	Magazine not securely locked	Tighten lock knob until detents drop in place.
	Shuttle sticking	Free the shuttle (para. 4-8).
Over-run indicator shows continually	Pressure plate springs too weak	Replace pressure plate.
	Over-run lever torsion spring broken	Return camera to overhaul depot for repair.

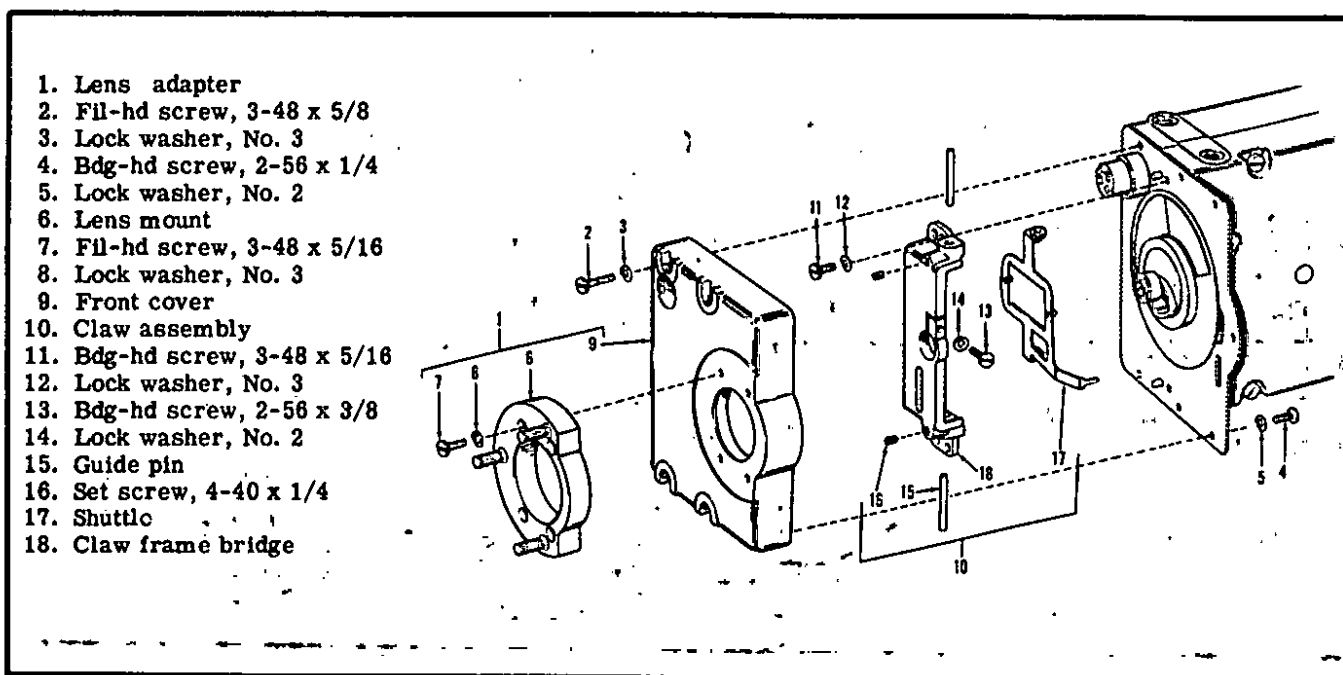


Figure 4-1. Removing the Film Shuttle

4-2. CAMERA ASSEMBLY.**4-3. LENS MAINTENANCE.**

4-4. CLEANING. Remove dust and lint from the lens filters and outer surface of the lens element with a soft, camel's hair brush. If necessary, polish the lens element with lens cleaning tissue, using a circular motion and working from the center to the edge of the glass.

NOTE

Under no circumstances should the lens be disassembled. Avoid leaving fingerprints on the lens surface.

4-5. REPLACEMENT. To remove the lens assembly, unscrew the three hex cap nuts from the lens adapter studs and withdraw the complete lens assembly from the camera.

4-6. SHUTTLE MAINTENANCE.**4-7. REMOVAL.** (See figure 4-1.)

a. Loosen the magazine lock knob and remove the film magazine. Remove the lens assembly (paragraph 4-5).

b. Remove four fillister head screws (2) and lock washers (3) and three binding head screws (4) and lock washers (5) and separate the front end adapter (1) from the camera body. Do not disassemble the lens mount (6) from the front cover (9) unless in need of replacement.

c. Remove two screws (11) and lock washers (12), loosen screw (13), and carefully pry the claw assembly (10) from the camera body. Loosen the two set screws (16) and disassemble the guide pins (15) and shuttle (17) from the bridge (18).

4-8. INSPECTION AND REPAIR.

a. Inspect the guide pins and the guide pin openings in the shuttle for burrs or distortion which may cause the shuttle to bind or stick. Burrs can be removed by polishing with crocus cloth. Make certain that the shuttle ears are not twisted or bent; straighten them, if necessary, by bending carefully with a pliers. Bent or distorted guide pins must be replaced.

b. Clean all parts with carbon tetrachloride (Federal Specification O-C-141) and dry thoroughly with clean, lint-free cloths. Wipe the exposed aperture plate and shutter with a cloth dampened in carbon tetrachloride.

4-9. REASSEMBLY. (See figure 4-1.)

a. Assemble the shuttle (17) to the bridge (18) with the guide pins (15). Apply Glyptol or similar cement to the threads of the set screws (16) and screw them into place. The inner end of each guide pin must be 0.590 inch (± 0.010 inch) from a center line drawn through the shutter bearing opening in the bridge. When the guide pins are accurately positioned, tighten the set screws securely.

b. Carefully install the assembled claw assembly (10) to the camera body. It may be necessary to rotate the shutter slightly during installation until the claw enters the slot in the aperture plate and the rectangular shuttle opening fits around the shutter cam. Then press the bridge down onto the locating pins protruding through the aperture plate. Make certain that the shutter bearing enters the bridge bearing opening squarely. Install and tighten the two screws (11) and lock washers (12), and the clamping screw (13).

c. Fasten the front end adapter (1) to the camera body with four fillister head screws (2) and lock washers (3) and three binding head screws (4) and lock washers (5). Do not tighten the four fillister

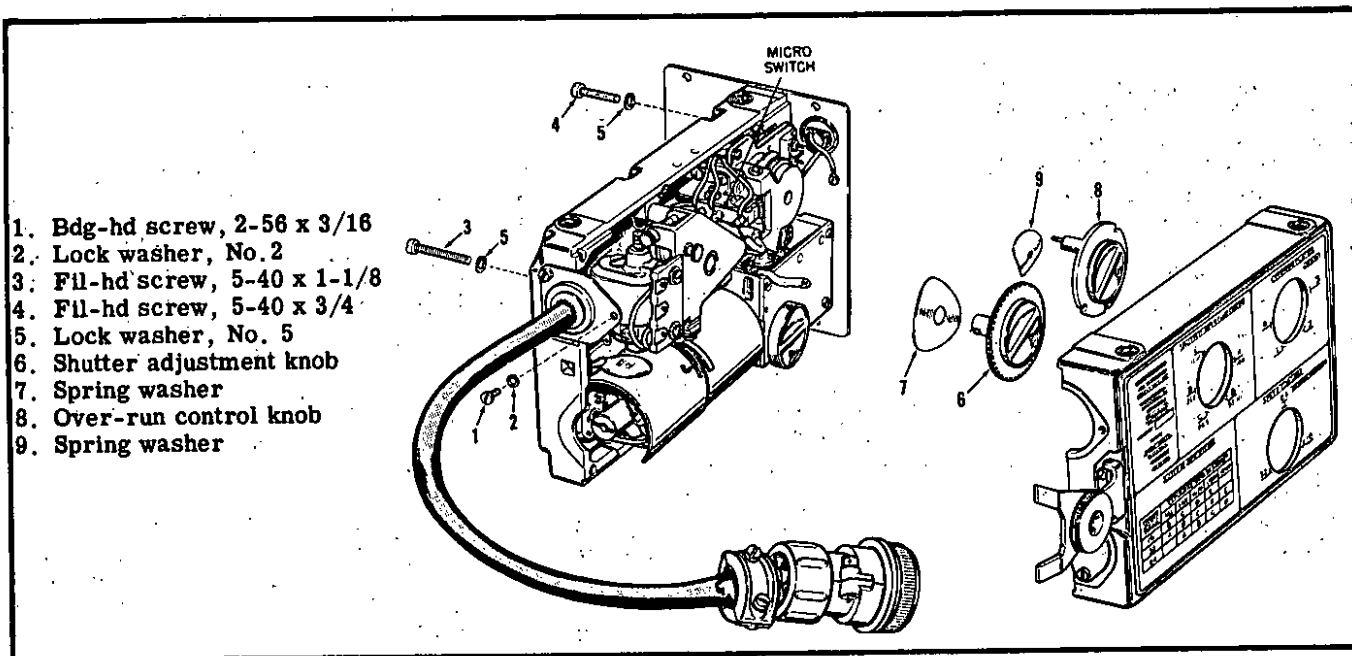


Figure 4-2. Separating the Camera Bodies

head screws at this time.

e. Loosen the six fillister head screws (3 and 4, figure 4-2) which assemble the upper camera body to the lower camera body. Tighten the four front end adapter screws securely; then tighten the body attaching screws.

f. Install the lens assembly and film magazine.

4-10. CAMERA BODY MAINTENANCE.

4-11. PARTIAL DISASSEMBLY. (See figure 4-2).

a. Remove the film magazine, the lens assembly (paragraph 4-5) and the front end adapter (paragraph 4-7).

b. Remove the binding head screw (1) and lock washer (2) at the "V" of the cable attaching plate.

c. Remove the six fillister head screws (3 and 4) which attach the upper camera body to the lower camera body and carefully separate these two assemblies.

d. The shutter adjustment knob (6) and its spring washer (7) and the over-run control knob (8) and its spring washer (9) can be lifted from position.

CAUTION

It is vitally important that the shutter adjustment knob be reinstalled in exactly the same position that it was before removal. Before removing this knob, make a note of the location of the small indicating arrow with respect to the shutter settings on the nameplate. When reinstalling the knob, position the arrow at the proper setting and insert the knob shaft down into place.

4-12. INSPECTION AND CLEANING.

a. Check the condition of all leadwires, and make certain that all leadwire connections are secure.

Tighten or carefully resolder connections where necessary.

b. Carefully blow all dust and lint from the camera mechanism with a low pressure jet of dry, compressed air. If compressed air is not available, use a soft brush to remove dirt particles.

c. Inspect the micro switch next to the over-run control to make certain that it has not loosened and shifted due to vibration. In such instances, it is possible for the dog on the over-run cam to catch and jam underneath the pivoting switch lever, thus making the camera inoperative. To remedy this, release the cam dog from beneath the lever, loosen the hex nuts that attach the micro switch to its mounting bracket, and press the switch as far as possible toward the over-run cam. Then tighten the hex nuts securely.

4-13. REASSEMBLY. (See figure 4-2).

a. Install the shutter adjustment knob (6) and its spring washer (7) and the over-run control knob (8) and its spring washer (9). Make certain that the indicating arrow of the shutter control knob is positioned exactly at the same setting noted before its removal. When installing the over-run control knob, the control knob stop pin must be inserted behind the cam dog of the solenoid plunger (figure 1-6).

b. Carefully assemble the upper camera body to the lower camera body and install (but do not tighten) the six fillister head screws (3 and 4, figure 4-2) and lock washers (5). The two longer screws (3) must be installed in the bottom holes toward the front of the camera body.

c. Secure the "V" of the cable attaching plate to the upper camera body with the binding head screw (1) and lock washer (2).

d. Install the front end adapter (paragraph 4-9); then tighten the six body attaching screws securely.

4-14. OVER-RUN INDICATOR LEVER ADJUSTMENT.

a. The over-run indicator lever must be adjusted so that the tip of the lever protrudes 0.062 (-0.015) inch into the upper corner of the aperture opening during the over-run cycle.

b. Remove the front end adapter (paragraph 4-7) and upper camera body (paragraph 4-11).

c. Loosen the stud set screw (figure 4-3) and rotate the eccentric stud to obtain the proper adjustment. Then tighten the set screw securely and reassemble the camera bodies and front end adapter (paragraph 4-13).

4-15. FILM MAGAZINE MAINTENANCE.

4-16. PARTIAL DISASSEMBLY. (See figure 4-5.)

a. Depress the magazine cover release button and slide the cover (1) from the magazine.

b. Carefully lift out the pressure plate (2); then remove the screw (4), lock washer (5) and film guide assembly (3).

c. Carefully pry the retaining rings (7 and 9) from the roller studs (10), and lift off the feed roller (6) and take-up roller (8). Remove the screws (11) and lock washers (12) and lift the roller studs (10), feed roller plate (13) and take-up roller bracket (14) from the magazine.

d. The magazine heater (15) now can be disassembled from the magazine by removing two flat head screws (16), hex nuts (17) and lock washers (18) at one end of the heater.

e. After the magazine heater has been removed, the sprockets (19 and 23), shim washers (20, 21, 22, 24, 25 and 26), gear shaft retainer (27), heater contact (28), and heater contact washer (29) are

free to be lifted from the magazine.

4-18. CLEANING AND INSPECTION.

a. Clean the aperture opening and all removed parts carefully with a clean, lint-free cloth. Hardened accumulations of dirt and film emulsion can be removed from film rollers, pressure plate, film guide arms and from between sprocket teeth with a cloth dampened with acetone (Federal Specification O-A-51b). It may be necessary to loosen dirt with an orange stick or tooth pick.

CAUTION

Do not use a metal tool to remove emulsion or accumulated dirt from the aperture opening or film path parts.

b. Inspect the sprockets for nicked or broken teeth and replace, if necessary. Examine the film contact surface of the pressure plate guide rollers and guide arms for scratches, nicks or burrs which may scratch the film. If defects cannot be removed by polishing with fine crocus cloth, the defective part, or parts, must be replaced.

c. Blow all dust and lint from the interior of the magazine with a low pressure jet of dry, compressed air or with a soft brush.

4-19. REASSEMBLY. (See figure 4-5.)

a. Place the heater contact washer (29), heater contact (28) and gear shaft retainer (27) in position within the magazine.

b. Install the sprockets (19 and 23) on their respective studs, first making certain that all shim

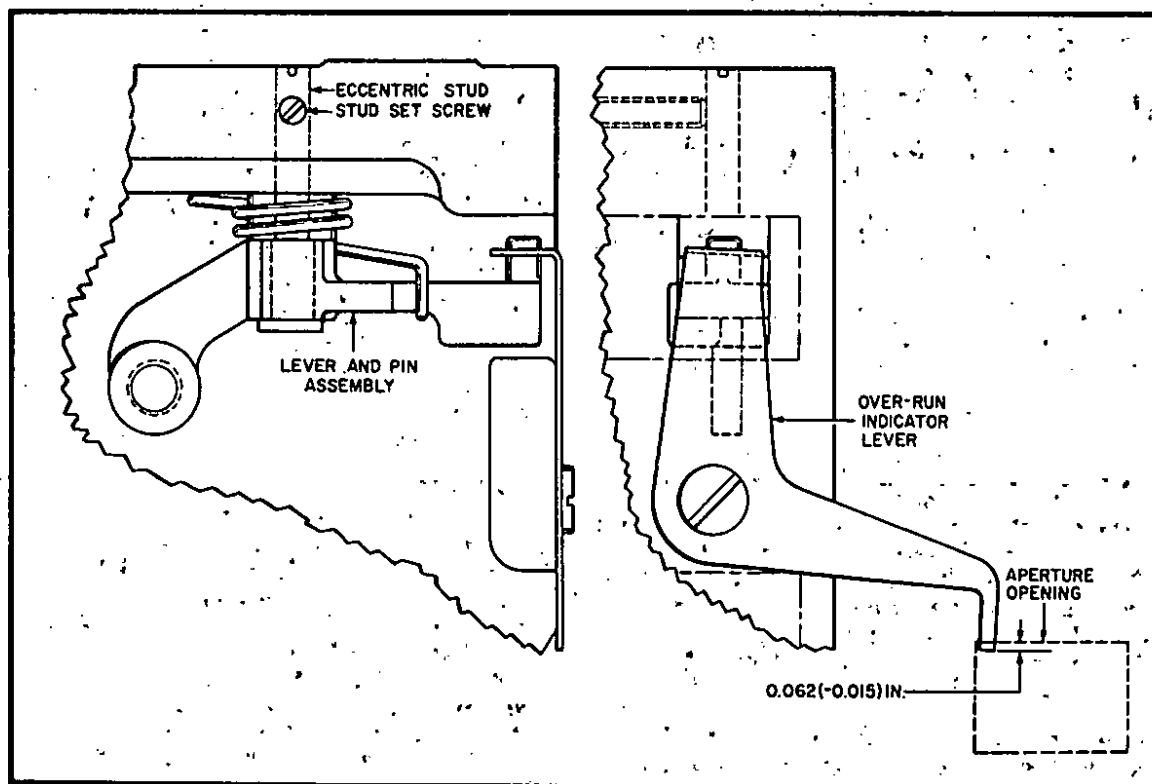


Figure 4-3. Adjusting the Over-run Indicator Lever

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Paragraph 4-19

washers removed during disassembly are in place.

c. Place the magazine heater (15) within the magazine and install the two flat head screws (16), hex nuts (17) and lock washers (18).

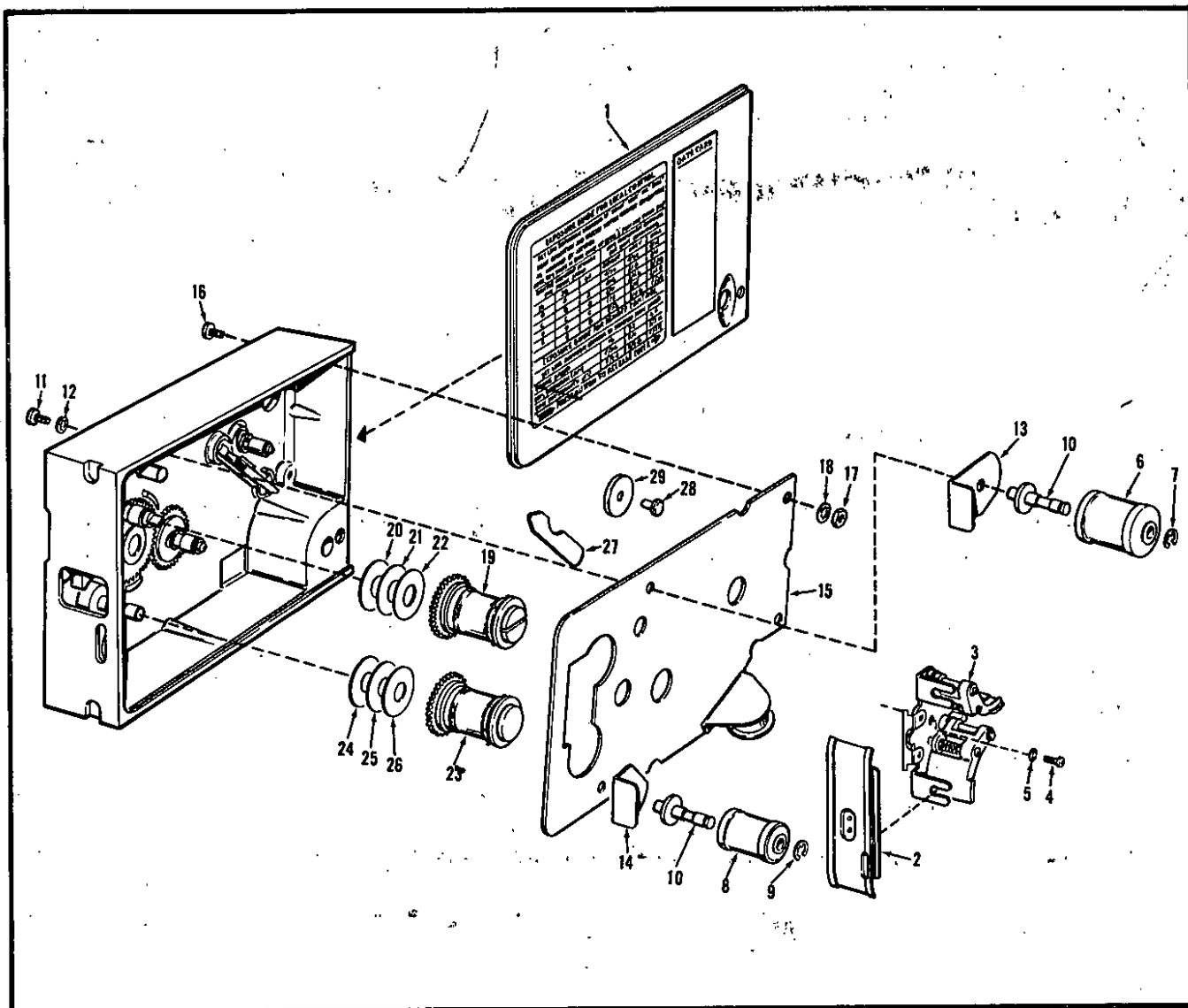
d. Assemble the feed roller plate (13) and take-up roller bracket (14) to the roller studs (10) and fasten each stud in place with a screw (11) and lock washer (12). Then secure the feed roller (6) and take-up roller (8) to their respective studs with the retaining rings (7 and 9).

e. Fasten the film guide assembly (3) in place

with the screw (4) and lock washer (5) and install the pressure plate (2).

f. Make certain that both sprockets are fully seated, and slide the magazine cover (1) into place. If the cover will not go on, check to see that the pressure plate has not been inverted in installation, and that it is seated below the cast rail at the front of the magazine.

g. Refer to paragraph 1-32 for the proper procedure for loading the magazine with film and for attaching the magazine to the camera body.



- | | | |
|-----------------------------|-------------------------------|----------------------------|
| 1. Magazine cover | 11. Bdg-hd screw, 2-64 x 3/16 | 20. Shim washer, 0.010 in. |
| 2. Pressure plate | 12. Shakeproof washer, No. 2 | 21. Shim washer, 0.005 in. |
| 3. Film guide assembly | 13. Feed roller plate | 22. Shim washer, 0.003 in. |
| 4. Bdg-hd screw, 2-56 x 1/4 | 14. Take-up roller bracket | 23. Take-up sprocket |
| 5. Shakeproof washer, No. 2 | 15. Magazine heater | 24. Shim washer, 0.010 in. |
| 6. Feed roller | 16. Flat hd screw, 2-56 x 3/8 | 25. Shim washer, 0.005 in. |
| 7. Retaining ring | 17. Brass hex nut, 2-56 | 26. Shim washer, 0.003 in. |
| 8. Take-up roller | 18. Shakeproof washer, No. 2 | 27. Gear shaft retainer |
| 9. Retaining ring | 19. Feed sprocket | 28. Heater contact |
| 10. Roller stud | | 29. Heater contact washer |

Figure 4-4. Disassembling the Film Magazine